CLAIMS

What is claimed is:

1. A contact pin assembly, comprising:

a substantially planar substrate;

a first contact pin having a contact end on a first side of the substrate and formed in place from a first portion of the substrate; and

first compliant coupling structure to couple the first contact pin in an orthogonally compliant orientation with the substantially planar substrate.

2. The contact pin assembly of claim 1, wherein the contact pin further comprises conductive material around at least a portion of the first contact pin.

3. The contact pin assembly of claim 2 wherein the first compliant coupling structure is an electrically conductive compliant coupling structure for electrically coupling the conductive material of the first contact pin with the substrate.

4. The contact pin assembly of claim 3 wherein the conductive material around at least a portion of the first contact pin comprises conductive plating for electrically coupling with the first compliant coupling structure.

5. The contact pin assembly of claim 2, further comprising a wire bond extending from the conductive material of the first contact pin to the substrate.

6. The contact pin assembly of claim 1 wherein the first compliant coupling structure is an elastomer material.

7. The contact pin assembly of claim 1 wherein the first contact pin further comprises a first conductor formed therein from the contact end to an interconnect end of the first contact pin.

8. The contact pin assembly of claim 7 wherein the first contact pin further comprises a conductive block coupled to one of the contact end and the interconnect end of the first conductor.

9. The contact pin assembly of claim 8 wherein the conductive block is generally rigid.

10. The contact pin assembly of claim 8 wherein the conductive block is comprised of a compliant material.

11. The contact pin assembly of claim 7 further comprising a wire bond from the interconnect end of the first conductor to the substrate.

12. The contact pin assembly of claim 1 wherein the first compliant coupling structure is a thinned portion of the substrate coupling an interconnect end of the first contact pin with the substrate.

13. The contact pin assembly of claim 1 wherein the substrate is thinner than a length of the first contact pin.

14. The contact pin assembly of claim 1 wherein the substrate is a semiconductor wafer.

15. The contact pin assembly of claim 1, further comprising at least one stop formed on the substrate and configured to establish a maximum range of motion of the first contact pin.

16. The contact pin assembly of claim 1, further comprising a conductive bump on the contact end of the first contact pin.

17. The contact pin assembly of claim 1, wherein the contact end of the first contact pin further comprises a profile configured to facilitate electrical coupling of the first contact pin with a contact pad of a device-under-test.

18. The contact pin assembly of claim 1, further comprising:

a second contact pin having a contact end on a second side of the substrate and formed in place from a second portion of the substrate; and

second compliant coupling structure to couple the second contact pin in an orthogonally compliant orientation with the substrate.

19. The contact pin assembly of claim 18, further comprising a conductive trace configured to electrically couple the first and second contact pins.

20. The contact pin assembly of claim 18, further comprising:

an electrically conductive via extending between the first and second sides; and

at least one conductive trace electrically coupled to the electrically conductive via and configured to electrically couple together the first and second contact pin.

21. A method of forming a contact pin assembly, comprising:

thinning a substrate around a first location on a first side defined for forming a contact end of a first contact pin, the contact end extending above the substrate by a height approximating an intended distance of travel of the first contact pin within the contact pin assembly transverse to a plane of the substrate;

locally thinning the substrate to form a first void immediately around the location of the first contact pin on the first side of the substrate to a selected depth;

at least partially filling the first void with a compliant coupling material; and

thinning a second side of the substrate to release the first contact pin in the first void from the substrate.

22. The method of claim 21, further comprising additionally thinning the first side of the substrate at a further distance away from the location to form a first stop on the first side of the substrate.

23. The method of claim 21, further comprising depositing a conductive material at least partially on surfaces within the first void and over the contact end of the first contact pin prior to the at least partially filling the first void.

24. The method of claim 23, wherein the depositing a conductive material comprises plating with an electrically conductive metal.

25. The method of claim 21, further comprising the compliant coupling material to be electrically conductive.

26. The method of claim 21, further comprising bonding an electrical conductor from the contact pin to the substrate.

27. The method of claim 21, wherein the locally thinning comprises etching the substrate to form the first void.

28. The method of claim 21, wherein the locally thinning comprises laser ablating the substrate to form the first void.

29. The method of claim 21, wherein thinning a second side of the substrate comprises chemically etching the second side of the substrate.

30. The method of claim 21, wherein thinning a second side of the substrate comprises one of mechanically grinding and abrasively planarizing the second side of the substrate.

31. The method of claim 21, further comprising forming a first conductor from the contact end to an interconnect end of the first contact pin.

32. The method of claim 31, further comprising forming a conductive block on at least one of the contact end and the interconnect end of the first conductor.

33. The method of claim 31, further comprising forming a conductive block of compliant material on one of the contact end and interconnect end of the first conductor.

34. The method of claim 31, further comprising forming a conductive bump electrically coupled to the first conductor on the contact end of the first contact pin.

35. The method of claim 21, further comprising wire bonding an interconnect end of the first contact pin with the substrate.

36. The method of claim 21, further comprising:

thinning the substrate around a second location on a second side defined for forming a contact end of a second contact pin, the contact end extending above the substrate by a height approximating an intended distance of travel of the second contact pin within the contact pin assembly transverse to a plane of the substrate;

locally thinning the substrate to form a second void immediately around the second location of the second contact pin on the second side of the substrate to a selected depth;

at least partially filling the second void with the compliant coupling material; and

thinning the first side of the substrate to release the second contact pin in the second void from the substrate.

37. The method of claim 36, further comprising forming a conductive trace configured to electrically couple together the first and second contact pins.

38. The method of claim 36, further comprising:

forming an electrically conductive via between the first and second sides; and

forming at least one conductive trace electrically coupled to the electrically conductive via and configured to electrically couple together the first and second contact pins.

39. A method of forming a contact pin assembly, comprising:

defining a location for a contact pin on a substrate;

thinning the substrate around the location on a side defined for forming a contact end of the contact pin, the contact end extending above the side of the substrate by a height approximating a distance of travel of the contact pin within the contact pin assembly;

locally thinning the substrate to form a void immediately around the location of the contact pin on the contact end side of the substrate; and

thinning an opposite side of the substrate to allow a portion of the substrate under the voids to provide a compliant coupling structure between an interconnect end of the contact pin and the substrate.

40. The method of claim 39, further comprising forming a conductor from the contact end to an interconnect end of the contact pin.

41. The method of claim 40, further comprising forming an electrically conductive contact tip on the contact end of the contact pin for electrically coupling with the conductor.

42. The method of claim 39, further comprising additionally thinning the substrate at a further distance away from the location to form a stop having a taller profile than other portions of the substrate.

43. A contactor card, comprising:

a substrate configured for attachment with a semiconductor tester; and

at least one contact pin assembly, including:

a substantially planar substrate;

a first contact pin formed in place from a first portion of the substrate; and

first compliant coupling structure to couple the first contact pin in an orthogonally compliant orientation with the substrate.

44. The contactor card of claim 43, wherein the contact pin further comprises conductive plating around at least a portion of the first contact pin.

45. The contactor card of claim 44, wherein the first compliant coupling structure is an electrically conductive compliant coupling structure for electrically coupling the conductive plating of the first contact pin with the substrate.

46. The contactor card of claim 45, wherein the substrate further comprises conductive plating for electrically coupling with the electrically conductive compliant coupling structure.

47. The contactor card of claim 44, further comprising a wire bond extending from the conductive plating of the first contact pin and the substrate.

48. The contactor card of claim 43, wherein the first compliant coupling structure is an elastomer material.

49. The contactor card of claim 43, wherein the first contact pin further comprises a first conductor from a contact end to an interconnect end of the first contact pin.

50. The contactor card of claim 49, wherein the first contact pin further comprises a conductive block coupled to one of the contact end and the interconnect end of the first conductor.

51. The contactor card of claim 50, wherein the conductive block is generally rigid.

52. The contactor card of claim 50, wherein the conductive block is comprised of a compliant material.

53. The contactor card of claim 49, further comprising a wire bond from the interconnect end of the first conductor to the substrate.

54. The contactor card of claim 43, wherein the first compliant coupling structure is a thinned portion of the substrate coupling an interconnect end of the first contact pin with the substrate.

55. The contactor card of claim 43, wherein the contact end of the first contact pin further comprises a profile configured to facilitate electrical coupling of the first contact pin with a contact pad of a device-under-test.

56. The contactor card of claim 43, wherein the contact pin assembly further comprises:

a second contact pin having a contact end on a second side of the substrate and formed in place from a second portion of the substrate; and

second compliant coupling structure to couple the second contact pin in an orthogonally compliant orientation with the substrate.

57. The contactor card of claim 56, wherein the contact pin assembly further comprises a conductive trace configured to electrically couple the first and second contact pins.

58. The contactor card of claim 56 wherein the contact pin assembly further comprises:

an electrically conductive via extending between the first and second sides; and

at least one conductive trace electrically coupled to the electrically conductive via and configured to electrically couple together the first and second contact pin.

59. A method of making a contactor card to test a semiconductor wafer, comprising:

defining at least one first side location for at least one first side contact pin on a first side of a substrate, the at least one first side location corresponding in position to at least one contact on the semiconductor wafer;

thinning the substrate on the first side of the substrate around each of the at least one first side location to allow the contact end to extend above the first side of the substrate;

locally thinning on the first side of the substrate to form a first side void immediately around each of the at least one first side location of the first side contact pin to at least a depth of the first side contact pin;

filling the first side void with a compliant coupling material; and

thinning a second side of the substrate to release the first side contact pin in the first side void from the substrate.

60. The method of claim 59, further comprising additionally thinning the substrate at a further distance away from the first side location to form a stop having a taller profile on the first side of the substrate.

61. The method of claim 59 further comprising depositing a conductive material at least partially on surfaces within the first side void and over the contact end of the first side contact pin prior to the at least partially filling the first side void.

62. The method of claim 61 wherein the depositing a conductive material comprises plating with an electrically conductive metal.

63. The method of claim 59 wherein the compliant coupling material is electrically conductive for electrically coupling the first side contact pin with the substrate.

64. The method of claim 59 wherein when the compliant coupling material is nonconductive, bonding an electrical conductor from the first side contact pin to the substrate.

65. The method of claim 59 wherein the locally thinning comprises etching the substrate to form the first side void.

66. The method of claim 59 wherein the locally thinning comprises laser oblating the substrate to form the first side void.

67. The method of claim 59 further comprising:

defining at least one second side location for at least one second side contact pin on the second side of the substrate, the at least one second side location corresponding in position to at least one contact on a tester;

thinning the substrate on the second side of the substrate around each of the at least one second side location to allow the contact end to extend above the second side of the substrate;

locally thinning on the second side of the substrate to form a second side void immediately around each of the at least one second side location of the second side contact pin to at least a depth of the second side contact pin;

filling the second side void with the compliant coupling material; and

thinning the first side of the substrate to release the second side contact pin in the second side void from the substrate.

68. The method of claim 67 further comprising forming a conductive trace configured to electrically couple together at least one the first side contact pins with at least one of the second side contact pins.

69. The method of claim 67, further comprising:

forming an electrically conductive via between the first and second sides; and

forming at least one conductive trace electrically coupled to the electrically conductive via and configured to electrically couple together at least one the first side contact pins with at least one of the second side contact pins.

70. A method of testing a semiconductor wafer, comprising:

aligning at least one contact pad of the semiconductor wafer with a corresponding at least one contact pin assembly on a contactor card, the at least one contact pin assembly each including:

a substantially planar substrate;

a contact pin formed from a portion of the substrate; and

compliant coupling structure to couple the contact pin in an orthogonally compliant orientation with the substrate;

compressing the semiconductor wafer against the contactor card to induce a compliant interconnection with the contact pin of the at least one contact pin with a corresponding contact pad on the semiconductor wafer; and

applying and analyzing at least one test signal at a tester through the contact pin assembly of the contactor card.

71. The method of claim 70, wherein the compressing comprises drawing a vacuum between the semiconductor wafer and the contactor card.

72. The method of claim 70, wherein the contact pin further comprises conductive plating around at least a portion thereof.

73. The method of claim 72, wherein the compliant coupling structure is an electrically conductive compliant coupling structure.

74. The method of claim 73, wherein the substrate further comprises conductive plating for electrically coupling with the electrically conductive compliant coupling structure.

75. The method of claim 71, further comprising a wire bond from the conductive plating of the contact pin and the substrate.

76. The method of claim 70, wherein the compliant coupling structure is an elastomer material.

77. The method of claim 70, wherein the contact pin further comprises a conductor from a contact end to an interconnect end of the contact pin.

78. The method of claim 70, wherein the contact pin assembly further comprises a wire bond extending from the interconnect end of the conductor to the substrate.

79. The method of claim 70, wherein the compliant coupling structure is a thinned portion of the substrate coupling an interconnect end of the contact pin with the substrate.

80. A semiconductor wafer testing system, comprising:

a contactor card, including:

a substrate configured for attachment with a semiconductor tester; and

at least one contact pin assembly, including:

a substantially planar substrate;

a contact pin formed from a portion of the substrate; and

compliant coupling structure to couple the contact pin in an orthogonally compliant orientation with the substrate; and

a tester configured to apply and analyze test signals from the semiconductor wafer via the contactor card.

81. The semiconductor wafer testing system of claim 80, wherein the contact pin further comprises conductive plating around at least a portion of the contact pin.

82. The semiconductor wafer testing system of claim 81, wherein the compliant coupling structure is an electrically conductive compliant coupling structure.

83. The semiconductor wafer testing system of claim 82, wherein the substrate further comprises conductive plating for electrically coupling with the electrically conductive compliant coupling means.

84. The semiconductor wafer testing system of claim 81, further comprising a wire bond from the conductive plating of the contact pin and the substrate.

85. The semiconductor wafer testing system of claim 80, wherein the compliant coupling structure is an elastomer material.

86. The semiconductor wafer testing system of claim 80, wherein the contact pin further comprises a conductor extending from a contact end to an interconnect end of the contact pin.

87. The semiconductor wafer testing system of claim 86, further comprising a wire bond extending from the interconnect end of the conductor to the substrate.

88. The semiconductor wafer testing system of claim 80, wherein the compliant coupling structure is a thinned portion of the substrate coupling an interconnect end of the contact pin with the substrate.

89. A device assembly for coupling with a substrate having at least one substrate contact pad, comprising:
a device having at least one device contact pad thereon; and
a contact pin assembly including:
a substantially planar substrate;

a contact pin having a contact end on a first side of the substrate for coupling with the at least one contact pad of the device and formed in place from a first portion of the substrate; and

first compliant coupling structure to couple the contact pin in an orthogonally compliant orientation with the substantially planar substrate.

90. The device assembly of claim 89, wherein the contact pin further comprises conductive material around at least a portion of the first contact pin.

91. The device assembly of claim 90, wherein the first compliant coupling structure is an electrically conductive compliant coupling structure for electrically coupling the conductive material of the first contact pin with the substrate.

92. The device assembly of claim 89, wherein the first compliant coupling structure is an elastomer material.

93. The device assembly of claim 89, wherein the first contact pin further comprises a first conductor formed therein from the contact end to an interconnect end of the first contact pin, the interconnect end for coupling with the at least one substrate contact pad of the substrate.

94. The device assembly of claim 89, wherein the first compliant coupling structure is a thinned portion of the substrate coupling an interconnect end of the first contact pin with the substrate.

95. The device assembly of claim 89, wherein the substrate is thinner than a length of the first contact pin.

96. The device assembly of claim 89 wherein the substrate is a semiconductor wafer.

97. The device assembly of claim 89, further comprising a first conductive bump on the contact end of the first contact pin.

98. The device assembly of claim 97, further comprising a second conductive bump on the contact end of the first contact pin.

99. The device assembly of claim 89 further comprising a redistribution conductive trace coupled between the contact end of the first contact pin and the at least one device contact pad.